Name: ……………………………………..
Class: ……………………
Date: ………………………
Practice 9

45

Section A

*Answer **all** questions in the spaces provided on the question paper.*

1. A boat is pulled at a steady speed through still water by two horizontal cables as shown in Fig. 1.1 (not drawn to scale) in top view. Using a scale of 1 cm to represent 10 000 N, draw a vector diagram to determine the magnitude and direction of the resultant force exerted on the boat by the cables.

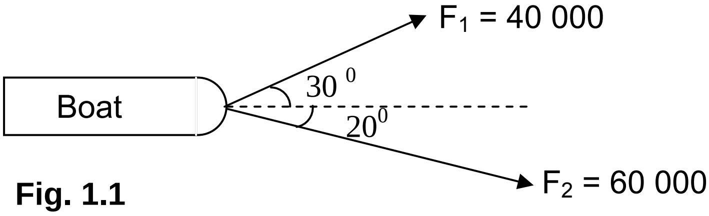

Fig. 1.1

Draw diagram to scale here: [2]

Magnitude:.. ……………………......... [1]

Direction: …………………………… [1]

2. A boy throws a ball vertically upwards with a velocity of 20 m s^{-1} and catches it again at its original starting point 4.0 s later. The velocity-time graph in Fig. 2.1 shows the motion of the ball.

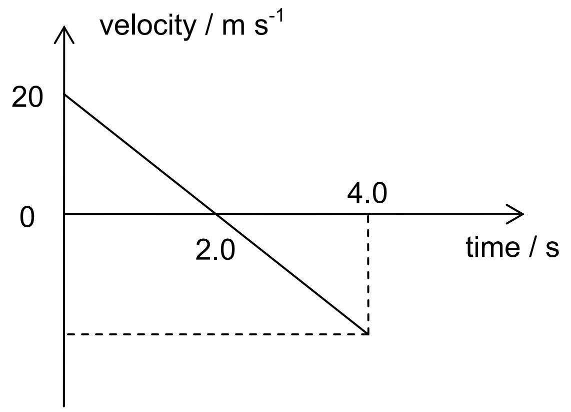

Fig 2.1

(a) Calculate the acceleration of the ball from t = 0 to 2.0 s.

Acceleration: …………………………… [2]

(b) What is the velocity of the ball at t = 4.0 s?

Velocity: …………………………… [1]

(c) Sketch the acceleration-time graph of the above motion using the axes provided in Fig. 2.2. State clearly the value(s) of the acceleration.

[2]

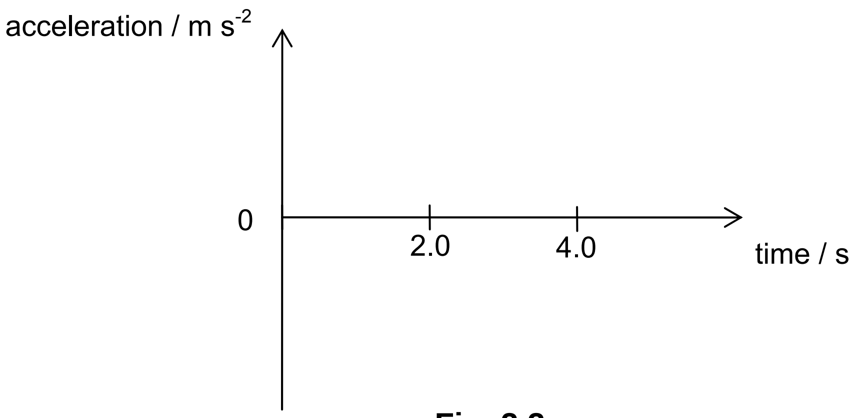

Fig. 2.2

3. Fig. 3.1 shows a car of mass 1500 kg initially at rest.

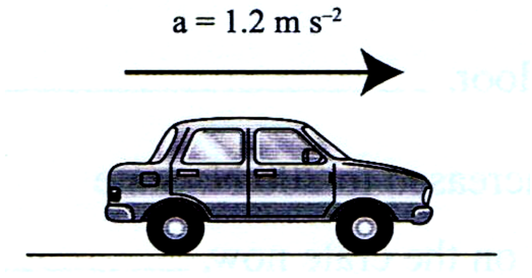

Fig. 3.1

(a) State the magnitude of friction acting on the car when it is at rest. Explain how you arrive at your answer. [2]

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(b) The car's engine provides a forward force that causes the car to accelerate to the right at a rate of 1.2 m s^{-2}. Calculate the net force acting on the car.

Net force: .... [2]

(c) From your answer in **(b)**, find the magnitude of friction acting on the car if it is known that the forward force is 3 000 N.

Friction: .... [2]

4. Fig 4.1 shows a half-metre rule of weight 5.0 N pivoted close to one end. The half-metre rule is supported by a spring and is loaded with a weight of 2.0 N as shown. All dimensions are marked on the diagram and are measured from the pivot.

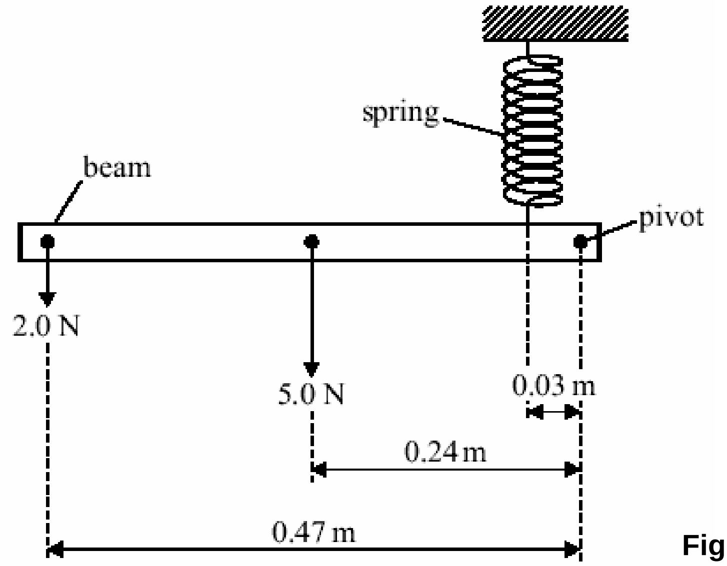

Fig. 4.1

(a) On the diagram above, draw an arrow to show the tension, **T** of the spring. [1]

[Turn Over

(b) By taking moments about the pivot, calculate the tension, **T** in the spring when the half-metre rule is horizontal.

Tension, **T**: …………………………… [2]

(c) State the position on the half-metre rule where the spring must be positioned so that the spring has a minimum tension. [1]

………………………………………………………………………………………..

5. A 250 kg car is released from rest down ramp A and reaches a speed of 20 m s^{-1} at point *X* as shown in Fig 5.1. The car moves up ramp B without additional force.

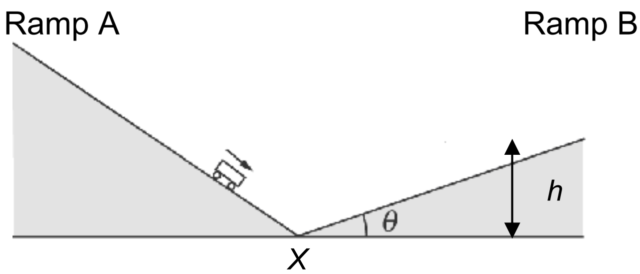

Fig. 5.1

(a) Find the kinetic energy of the car at point *X*.

Kinetic Energy: …………………………… [1]

(b) What is the maximum height (h) at which the car will reach along ramp B?

Maximum height: …………………………… [2]

(c) What is the average speed of the car along ramp B?

Average speed: …………………………… [1]

(d) Assume that the angle of inclination θ of ramp B is reduced, and the maximum height reached by the car is the same as your answer in **(b).** Will the time taken by the car to reach this maximum height be the same, longer or shorter as before? Explain why. [2]

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6. Fig. 6.1 shows words seen through a lens. Fig. 6.2 shows the same words without the lens.

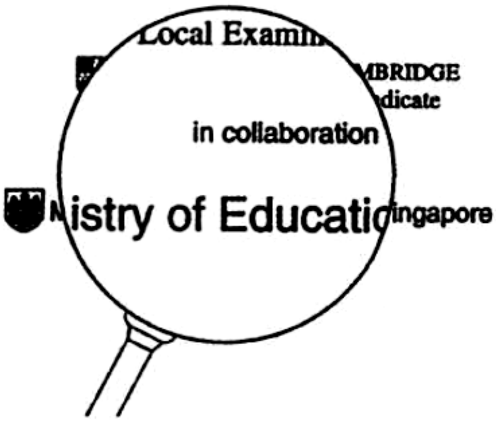

Fig. 6.1

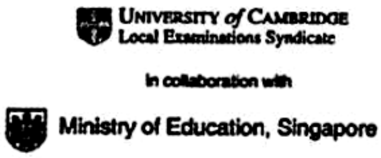

Fig. 6.2

(a) State **two** properties of the image formed by the lens. [2]

……………………………………………………………………………………...

……………………………………………………………………………………...

(b) On Fig. 6.3, draw two rays to show how the image was formed by the lens. Mark clearly the focal point **F** of the lens and the image formed. [2]

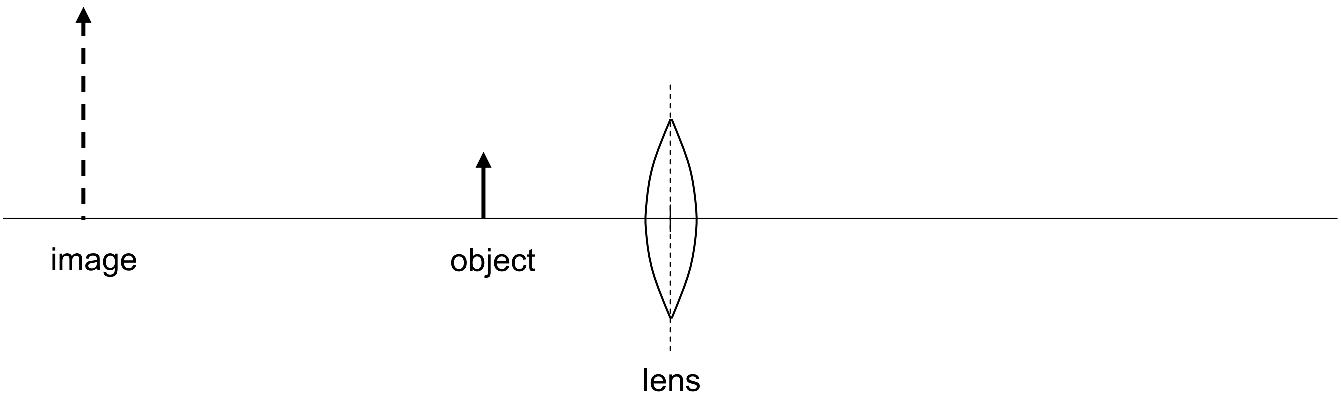

Fig. 6.3

7. X-rays, microwaves, ultraviolet rays and infra-red waves are different types of radiation in the electromagnetic spectrum,

(a) Write the name of one of these types of radiation in each of the boxes below, placing them in order of increasing wavelength. [2]

shortest wavelength ⟶ longest wavelength

(b) State one use of ultraviolet radiation. [1]

……………………………………………………………………………………...

……………………………………………………………………………………...

(c) State one other property that all types of radiation in the electromagnetic spectrum have in common other than their speed in vacuum. [1]

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8. A strip of plastic is rubbed with a piece of dry cloth and then hung over an insulating rod as in Fig. 8.1 below.

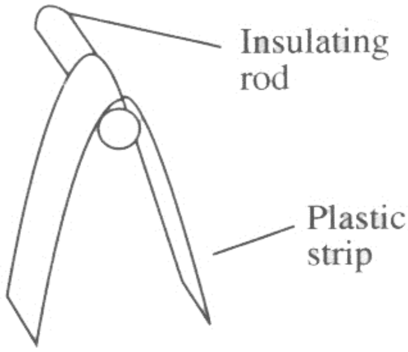


Fig. 8.1

(a) **(i)** What happens to the plastic strip when it is rubbed with a dry cloth? [1]

…………………………………………………………………………………

…………………………………………………………………………………

(ii) Why do the ends of the strip diverge? [2]

…………………………………………………………………………………

…………………………………………………………………………………

(b) Draw the electric field pattern between two isolated point charges as shown in Fig. 8.2 below. [2]

Fig. 8.2

9. Fig. 9.1 shows a battery of emf $\mathcal{E}$ connected to 3 resistors.

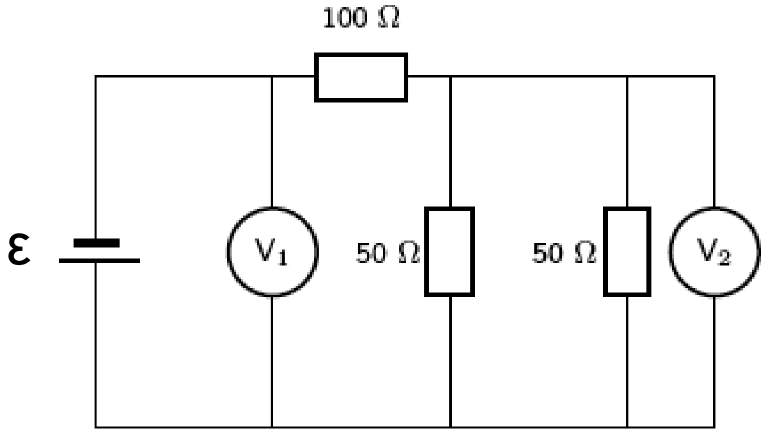


Fig. 9.1

(a) Explain what is meant by the emf of a battery. [1]

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

(b) The power dissipated in the 100 Ω resistor is 0.81 W.

(i) Calculate the current in the 100 Ω resistor.

Current: …………………………… [1]

(ii) Calculate the reading on voltmeters V_1 and V_2.

Reading on V_1: .... [1]

Reading on V_2: .... [1]

(iii) Calculate the emf ε of the battery.

emf ε : .... [1]

10. The charge is allowed to enter a magnetic field as shown below. Sketch on Fig. 10.1 the trajectory of the charge. [2]

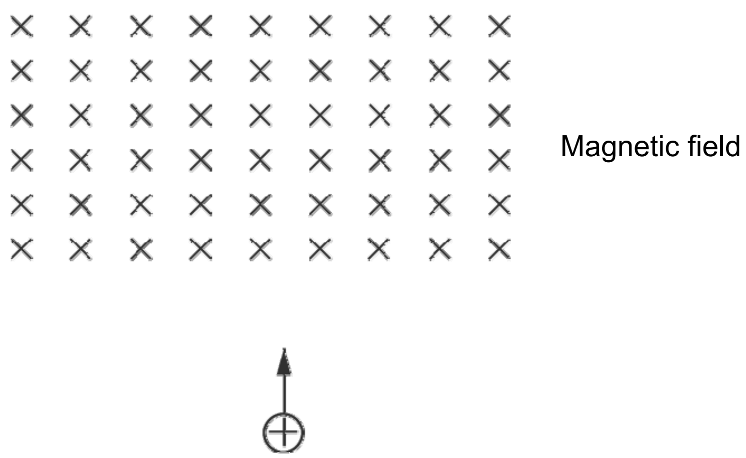


Fig. 10.1

Section B

Answer ***any two*** *questions on the lined papers provided and, if necessary, continue on separate answer paper. If you attempt Question 11(c), please use the diagrams provided on the Question Paper itself.*

11. Fig. 11.1 shows, ***to scale***, an irregularly shaped flat metal sheet freely pivoted at **P** on a horizontal pivot so that the plane of the sheet is vertical. The centre of gravity of the sheet is marked **C**.

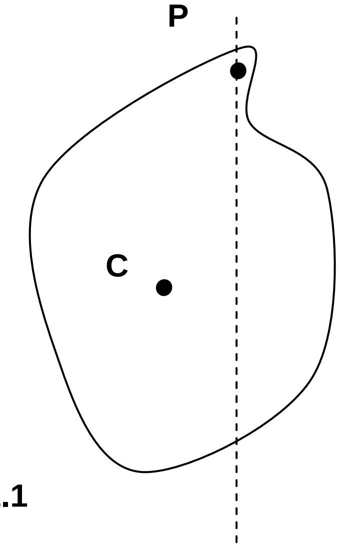


Fig. 11.1

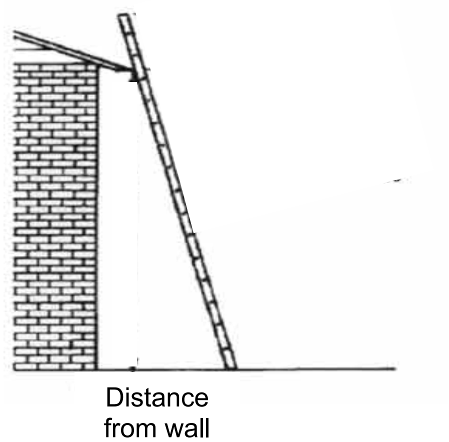
(a) Describe and explain what happens when the sheet is released from the position shown. [4]

(b) The metal sheet has a weight of 20 N. By taking the necessary measurements from the given diagram above, calculate the moment of the sheet about **P**. [2]

(c) A piece of lead of weight 40 N is to be fixed onto the metal sheet in order to keep the metal sheet balanced in the given position. Indicate ***on the Fig. 11.1 above***, with a cross, as accurately as possible, the position of this lead. [2]

(d) Fig. 11.2 shows a ladder placed against a building with its foot very near the wall. Describe and explain what may happen to a man who attempts to climb up this ladder. [2]

Fig. 11.2



12.

(a) Using a labelled diagram, briefly describe how sea breeze is formed during the day. [4]

(b) Fig. 12.1 shows a simple vacuum flask. Briefly describe how transfer of heat by conduction, convection, radiation and evaporation from the hot liquid to the surrounding is reduced. [4]

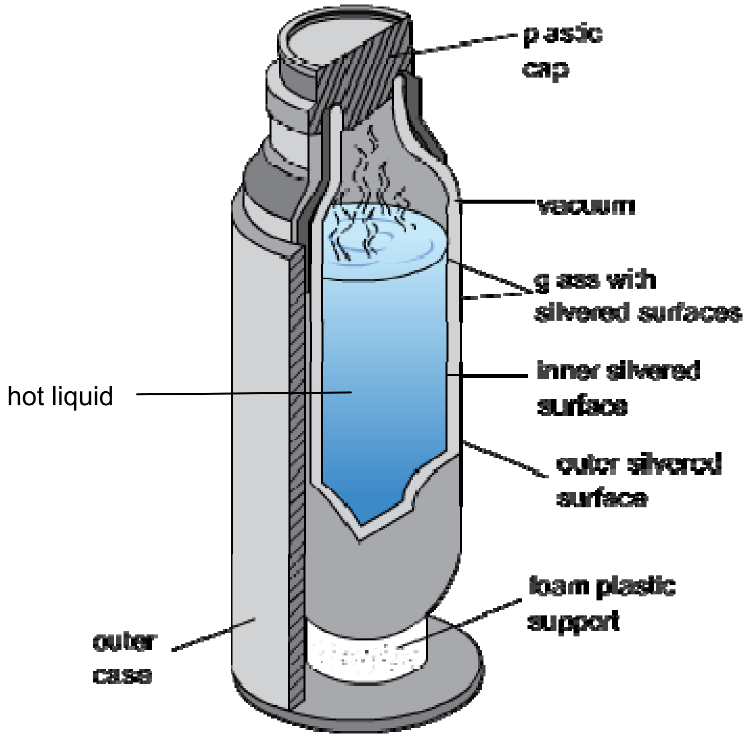


Fig. 12.1

(c) State **two** differences between evaporation and boiling. [2]

13. In experiments with a vertically held bar magnet, its ability to attract soft iron tacks is tested. The results are shown by the figures below. "S" indicates the south pole of the magnet.

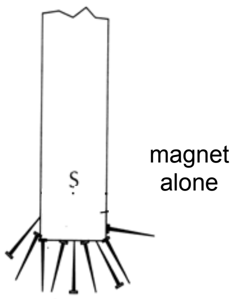


Fig. 13.1

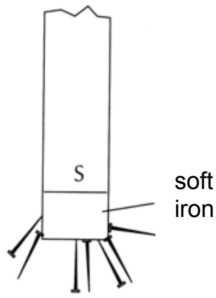


Fig. 13.2

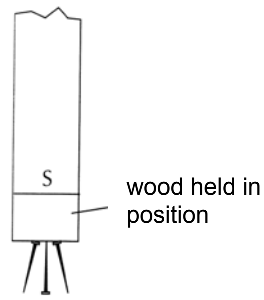


Fig. 13.3

(a) In Fig. 13.2, what happens to the soft iron as it is placed in contact with the magnet? [1]

(b) Suggest the difference in the number of tacks attracted if the soft iron is replaced with steel. [2]

(c) If the soft iron is gently slid off the end of the magnet whilst holding the iron tacks, state and explain what would happen. [2]

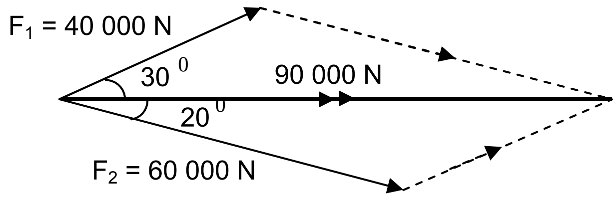
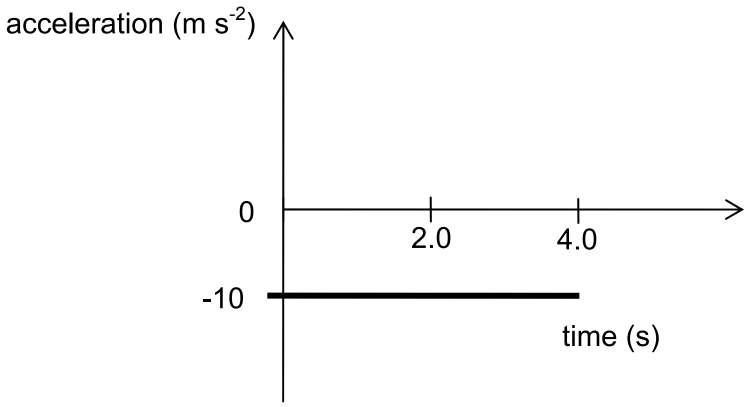
(d) In Fig. 13.3, although wood is a non-magnetic material, a few tacks are attracted when the wood is held covering the end of the magnet. Suggest a reason for this. [1]

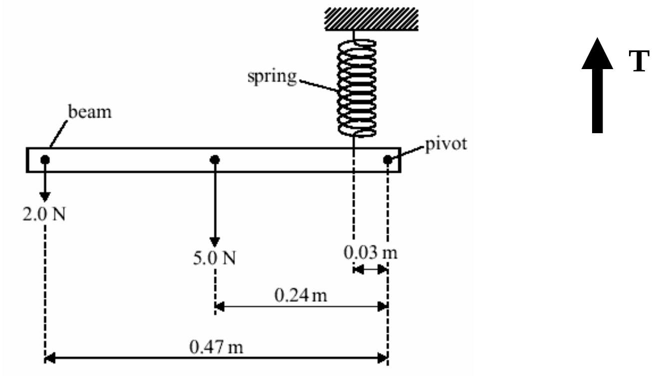
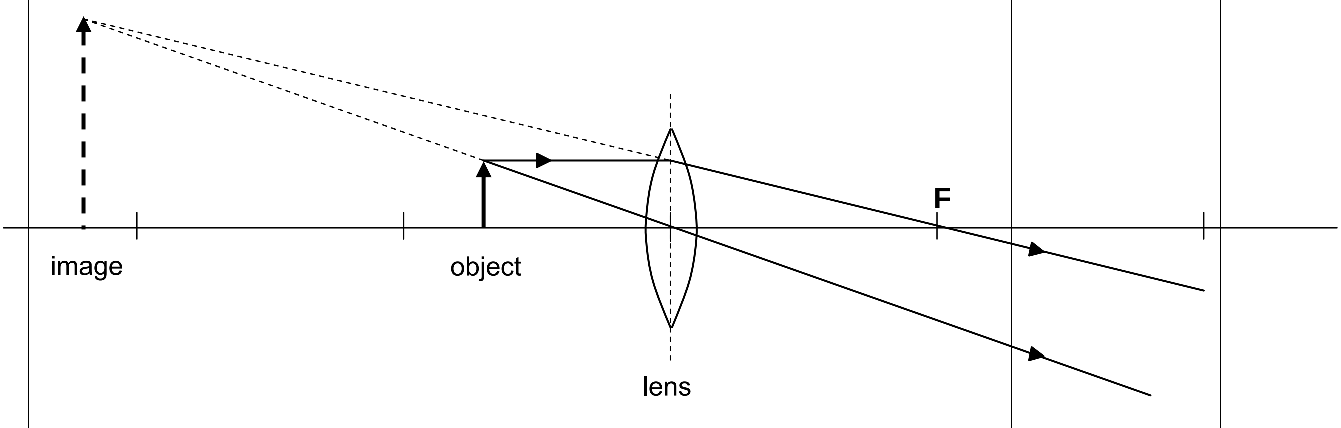
(e) Using a lower voltage d.c. supply, briefly explain with a labeled diagram, how a bar of soft iron can be magnetized. [2]

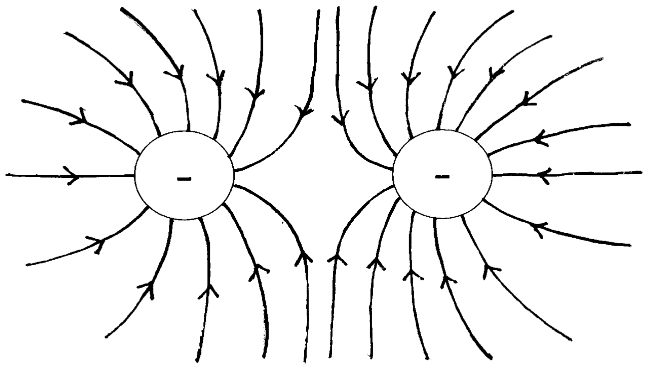
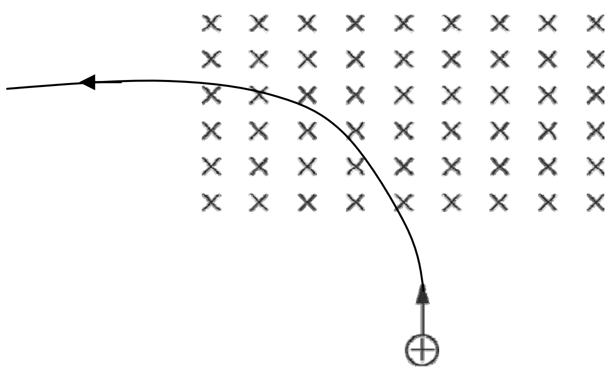
(f) State two ways of increasing the strength of the magnet in **(e).** [2]

Suggested solutions for 4EX/5NA Science-Physics Prelim Exam

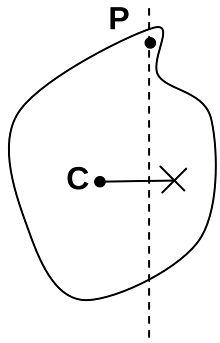
Paper 2 Section A

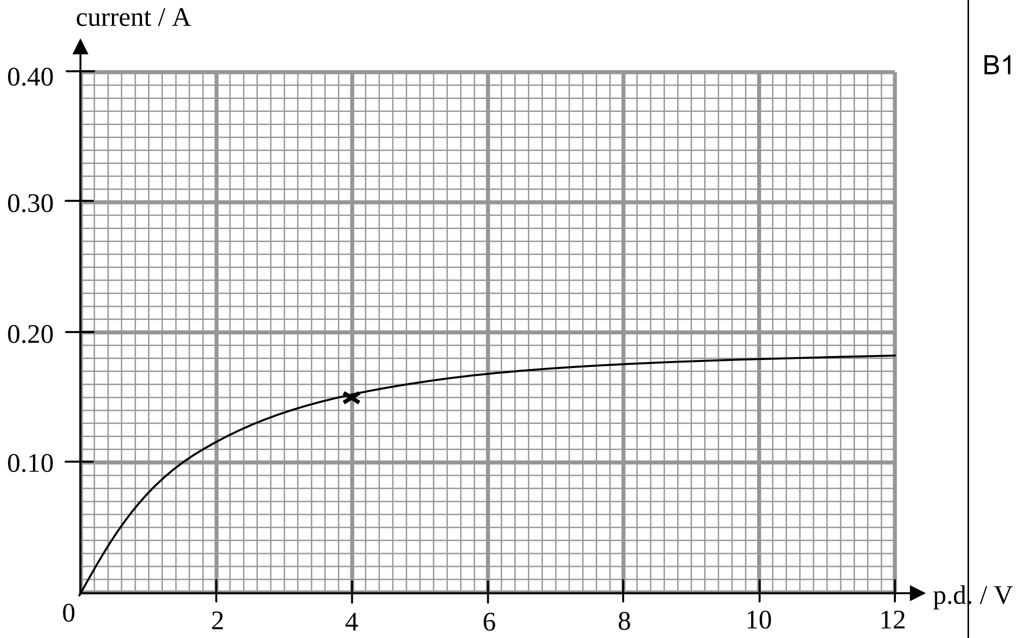
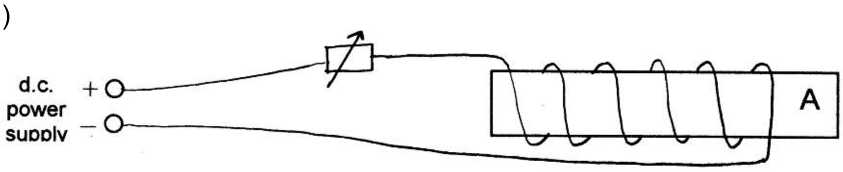
1	Use parallelogram law or triangular law for vector addition and indicate the resultant force with a double arrow.  Magnitude = 90 000 N ± 2 000 N, Direction: To the East or 20° away from 60 000 N forces or 30^0 from the 40 000 N force Calculated value: 91024N; 19.67° from the 60000 N force	B2 Minus 1 mark for missing arrows (max). If using parallelogram law, minus 1 mark if all solid lines B1 B1
2	(a) a = (v – u)/t = <u>**- 10 m s^{-2}**</u> (b) since a = (v – u)/t v = u + at = 20 + (-10)4 = <u>**- 20 m s^{-1}**</u> (c) 	M1, B1 B1 B1: horizontal line below x-axis. B1: for labeling 10”
3	(a) No friction is present since the car is at rest. (b) F = ma = 1 500 x 1.2 = 1 800 N (c) Friction = 3 000 – 1 800 = 1 200 N	A1 M1, A1 M1, A1
4	(a)	A1

		M1 B1 A1
	(b) At equilibrium, Sum of clockwise moments = Sum of anticlockwise moments **T** x 0.03 = (5 x 0.24) + (2.0 x 0.47) **T** = <u>**71.3 N**</u>	
	(c) At the 50cm mark / at the pivot.	
5	(a) KE at *A* = ½ m v^2= = <u>**50 000 J**</u>	B1
	(b) By law of conservation of energy, PE at point *B* = KE at point *A* *mgh* = 50 000 ∴ *h* = <u>**20 m**</u>	M1 B1
	(c) Distance traveled = 0.5 x t x 20 (based on area under graph) Thus, average speed = Distance Travelled / Time taken = (0.5 x t x 20) / t = <u>**10 m s^{-1}**</u>	 B1
	(d) Time taken is longer because the car will have to travel a **longer distance** to reach the same height. (With the angle of inclination decrease the deceleration will be less and the car will take a longer time to travel a longer distance.)	B2
6	(a) Image is virtual and upright.	B2
	(b) 	B2
7	(a)	

		shortest wavelength → longest wavelength X-rays | ultraviolet rays | infra-red waves | microwaves	B2
	(b)	Astronomy to detect very hot objects in space from space observatories orbiting around the Earth or induces the production of Vitamin D in the human skin or equilvalent.	A1
	(c)	All are transverse waves They obeys the wave equation, $v = f\lambda$	B1
8	(a)	(i) The plastic strip becomes electrically charged. (ii) The strip carries the same type of electric charge. Like charges repel so the ends of the same strip repel away from each other.	B1 B1 B1
	(b)		B2
9	(a)	Energy converted into electrical energy to drive unit charge around an electrical circuit	B1
	(b)	(i) $P = I^2R$ So $I = \sqrt{(0.81/100)}$ = **<u>0.09 A</u>** ii) Current through 50 Ω resistor = 0.045 A, V_2 = 0.045 x 50Ω = **<u>2.25 V</u>** Since total resistance = 100 + 50//50 = 125 Ω Hence, V_1 = 0.09 x 125 = **<u>11.25 V</u>** iii) emf = V_1 = **<u>11.25V</u>**	B1 B1 B1 B1
10		 Magnetic field	B2

Paper 2 Section B

11	(a)	The sheet will **oscillate about P** until it finally comes to **rest with the point C below P**.	B2
		The sheet will oscillate about **P** as long as the **moment** of the weight of the metal sheet, acting at **C** which is the centre of gravity, about **P** is **non-zero**.	B2
	(b)	Moment of the weight = F x d = 20 x 0.6 = **12 N cm** (Accept 20 x 0.7 = 14 N cm or 20 x 0.65 = 13 N cm)	M1, B1
	(c)	Correct position of cross at **3 mm** from line passing through P  **Fig. 8.1**	B2
	(d)	With the ladder too near the wall, the base area is small. As he climbs up, the centre of gravity is high. This is not stable and he may fall.	B2
12	(a)	Voltmeter 1: Reading is 12 V when C is at position X. As C moves towards Y, the reading will decrease.	B1
		Voltmeter 2: Reading is 0 V when C is at position X. As C moves towards Y, the reading increases(?).	B1
		Ammeter: When C is at position X, the ammeter reading will be maximum. As C moves towards Y, the ammeter reading will decrease.	B2

	(b)	(i) 	B1
		(ii) A filament lamp is a non-ohmic conductor. As current increases, its resistance increases. Since the gradient of an I-V graph is 1/R, hence the graph is a curve with a decreasing gradient.	B1 B1 B1
		(iii) From graph, when V = 4.0 V, I = **0.15 A** Thus, Q = It = 0.15 x 5 x 60 [1] = **45 C**	B1 B1
13	(a)	It gets magnetised or becomes an induced magnet.	B1
	(b)	smaller number of tacks attracted; as steel is a hard magnetic material, not easily magnetized	B1 B1
	(c)	All the tacks drop off; iron is a soft magnetic material, so it becomes demagnetized.	B1 B1
	(c)	The magnetic field can pass through wood.	B1
	(d)	 1 mark for drawing solenoid, 1 mark for correct current direction	B2
	(e)	Increase no. of turns of coil; increase current	B1 B1
12	(a)	In the day, the sun heats up the land faster than the sea. This is partly due to efficient conduction of the ground and due to water being a poor conductor of thermal energy. Hence, the air above land gets heated, expands and rises. Cool air above sea then moves inland to take its place. The result is a	B1 B1 B1

		sea breeze. (Diagram)	B1
	(b)	No thermal energy can enter of leave the flask by conduction or convection across the vacuum.	B1
		The inner silvered surface reflects radiation from the hot fluids back into the flask. The outer silvered surface reflects radiation in the external surroundings away from the flask.	B1
		The foam plastic support and plastic cap also minimize the thermal energy transmitted by conduction through the thin glass walls of the flask.	B1
		Lastly, the plastic cap stops convection and evaporation.	B1
	(c)	Any 2 of:	B2

Evaporation	**Boiling**
Slow	Quick
Nothing visible happens	Bubbles formed
Occurs from surface only	Occurs throughout the liquid
Occurs at all temperatures	Occurs at one temperature – boiling pt
Energy supplied by surroundings	Source of energy needed